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EXPERIMENTING WITH FIRES: TOWARD A NEW OPERATIONAL CONCEPT

By

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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The means for development and evaluation of the Ring of Fire is the Fleet Battle Experiment series. These experiments are an incremental process. User input is the basis for experiment design, and execution includes their participation. Analysis of the results, inclusion of increasingly complex capabilities, and a more sophisticated operating environment provide the foundation for future experimentation.

Five Fleet Battle Experiments have taken place to date. Through them, the Ring of Fire has matured in size and scope from its initial sea-based unit level operations. By incorporating land-based and airborne sensors and weapons platform the Ring of Fire has evolved into a scalable, fully integrated maritime and ground engagement system.

Further experimentation conducted in close cooperation with operational forces is necessary. Continuing the procedure in a variety of diverse environments will provide the operational commander a joint fires system that is capable of supporting the entire range of conflict. Persistence in developing the Ring of Fire through the Fleet Battle Experiment process will also ensure the discovery of system inadequacies and address potential solutions.

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The Ring of Fire concept is a net-centric system under evaluation by the naval services. Its purpose is to provide the Joint Force Commander the ability to plan and execute joint fires in the littoral battlespace. The requirements of CINCs and operational commanders are the basis for development of this joint networked fires delivery system.

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Introduction

The Ring of Fire (ROF) is an operational concept under development to provide the Joint Force Commander (JFC) with joint operational fires and tactical fire support in the littoral battlespace. The concept integrates sensors, command and control, and weapons systems from air, land, surface, and subsurface regimes. The ROF considers current and future technology to make doctrinal concepts such as the *Naval Operational Concept, Forward... from the Sea,* and *Operational Maneuver From the Sea* effective means for achieving the goals of Joint Vision 2010.[1]

A series of Fleet Battle Experiments (FBE) are the basis for the development of the ROF concept. The FBEs are primarily Navy evolutions executed in close cooperation with the Marine Corps, and in conjunction with the other services; eventually these experiments may include selected combined forces. The FBEs are in effect conceptual building blocks: each successive FBE incorporates increasingly sophisticated assets, broader operational scenarios, and addresses issues identified during the analysis of the results of preceding FBEs.

The advancement toward a net-centric future hinges on the maturation of the ROF concept through the FBEs. This approach links the user to the concept from the beginning, allowing a development process based on user needs. This will provide the operational commander the control, awareness, integration, and coordination necessary to most effectively utilize joint fires assets in support of joint operations in the littorals.

This paper presents operational commanders and their planning staffs a comprehensive overview of the implications of the ROF, analyzes how FBEs work to expand and enhance the ROF concept, and identifies areas for continued

experimentation and development through further FBEs. The focus is on concepts and capabilities rather than the development of future technology.

What is the Ring of Fire?

The ROF concept is a joint distributive fires network. This network enables the Joint Force Commander (JFC) to plan and execute fires in the Joint Operations Area (JOA). The ROF concept networks artillery, naval fires, close air support, and deep strike land-attack assets much like a Local Area Network links personal computers within an office complex. This permits the JFC to employ — in real time — the effects of a variety of weapons systems.[2] By doing so, the ROF allocates firepower rather than the system from which it emanates. This allows individual platforms or weapons systems — which are becoming increasing limited in number — the freedom to conduct multiple missions rather than being limited to direct support of one or a few missions.

The ROF FBE series offers geographic CINCs and operational commanders an incremental, user-oriented forum for directly participating in the experimentation and development of fire-related issues as they specifically relate to the threat and battlefield environment in their theaters of operations.

The Ring of Fire at Sea: FBE-Alfa

FBE-Alfa used the Marine Corps' Hunter Warrior Advanced Warfighting Experiment (AWE) scenario to explore advanced technologies and warfighting methods employing a sea-based expeditionary force engaged in Operational Maneuver

from the Sea.[3] FBE-Alfa examined C4ISR[4] capabilities and requirements for a sea-based JFC; it also examined how to incorporate advanced Naval Surface Fire Support and advanced munitions concepts, including Theater Ballistic Missile Defense, under the ROF concept.[5] FBE-Alfa simulated a ROF comprised of a carrier air wing, an arsenal ship-type weapons platform, the airborne Joint Surveillance Targeting Attack Radar System (JSTARS), and Aegis cruisers. Through modeling and simulation, these platforms provided for the evaluation of networked Calls For Fire (CFF) and allocation of response assets.

FBE-Alfa examined whether the ROF could respond rapidly and effectively by incorporating a group of firing platforms into a single network. The experiment found that the ROF allowed the JFC to net together all the fires assets at his disposal and to launch them remotely as massed fires from distributed weapons platforms. Within the ROF, systems operators were able to manually pair ordnance to a specific type of target. As a result, the variety of weapons-matching options available to the JFC rose with the number and diversity of firing platforms available within the ROF. However, to make weapon-to-target matching more efficient, the Joint Munitions Effectiveness Manual (JMEM)[6] must become an automated part of the fire control system's weapon pairing process. Integrating this information into the ROF will allow the system to choose the most effective weapon available based on target type and location, and platform and ordnance availability. This will provide the desired effects with greater speed and accuracy than a human operator performing a manual data search and weapon selection.

FBE-Alfa also demonstrated that any node in the system could function as the master controller and fire the weapons systems of any another node.[7] This expands the JFC's asset and range options by allowing a more distant platform to execute a fire mission using ordnance from one closer to the target, but currently occupied with another mission or self-defense. Additionally, the experiment demonstrated that the ROF could automate functions for inventory and apportionment of ordnance to component commanders. This gives the JFC increased control of limited ordnance and timely knowledge of reallocation and replenishment requirements. However, further development of these attributes must also provide for the dissemination of this information along with a continually updated commander's guidance to all participants. This ensures that each user and provider is aware of the amount and type of ordnance available, and how it is best utilized.

FBE-Alfa highlighted a number of areas that need further exploration if the ROF concept is to be a useful tool at both the operational and tactical levels. First, the ROF must distinguish between immediate tactical fires required by units in contact with enemy forces, and those scheduled for interdiction and deep strike. That is, the ROF must include a decision system that prioritizes fire missions and ordnance pairing on two levels: operational and tactical. Second, a Forward Observer/Forward Air Controller (FO/FAC) must be able to supplement digital CFF with voice communications. Only through human to human voice communication to a system operator can one convey the urgency that may exist when engaging an enemy at close range. At the operational level, target prioritization is generally less time sensitive, but

voice communication is also advantageous for time critical targets such as SCUD missile launchers.

Joint Targeting and Fires: FBE-Bravo

Leveraging off the analysis and lessons of Alfa, FBE-Bravo focused on the operational concept of precision engagement in support of Joint Vision 2010 and the *Naval Operational Concept* (NOC).[8] FBE-Bravo expanded the ROF experimentation to include joint fires coordination and a Joint Task Force (JTF) targeting process. The experiment examined the creation of an interface between sensor-to-shooter targeting from over the horizon, with shipboard and land-based fires coordination systems. Tactical aircraft replaced the simulated carrier air wing used in FBE-Alfa.

FBE-Bravo demonstrated that the ROF is scalable to the tactical level and that it can respond to a high rate of CFF by applying an array of distributed weapons platforms. The results indicate that the ROF is also scalable to the operational level and is applicable to the planning and execution of joint fires throughout the JOA. The experiment provided netted functions for the ROF by extending the Land Attack Warfare System (LAWS)[9], the ship-based battlespace management infrastructure. Successful integration of LAWS, the Advanced Field Artillery Tactical Data System (AFATDS)[10], and observers sending digital CFF demonstrated the necessary links required to provide the JFC and the land component commander the netted command and control capabilities they require as a major amphibious operation maneuvers ashore.[11]

The LAWS operators rapidly learned to use the system effectively.[12] Each shipboard LAWS node consisted of three stations operated by a single individual and one Battle Watch Captain monitoring these stations. The operators incorporated the commander's guidance for the prioritization of targets into their decision-making and determined type ordnance, firing platform, and mission validity. This integrated LAWS provided the JFC an interactive, streamlined process for servicing more targets in less time, and more efficiently using available weapons platforms.

However, further automation of LAWS or its successor is necessary. As net-centric warfare evolves, the ROF's battle management infrastructure must provide for the JFC's intent and guidance to become part of the systems prioritization logic through digital entry. As mentioned above, the JMEM must become part of the fire control system's weapons-target pairing process. This pairing process can also determine which firing platform will fire based on time of flight, platform status, and how the JFC planned to use available assets. To prevent fratricide, tracking data digitally supplied by ground forces to LAWS should also be an integral part of the system.

Fully automating these features will relieve system operators of decisions that are more rapidly and accuracy accomplished by computer. Operators can then focus more closely on mission suitability and safety. Similarly, Battle Watch Captains can effectively monitor and direct three operator's stations simultaneously. As the system currently operates, the Battle Watch Captain cannot effectively monitor all the decisions made by three operators during high-rate use.

FBE-Bravo indicated that more automation is needed in order to make the integration advantages of the ROF concept overcome the increased risk of fratricide, and to take full advantage of the concept's potential.

Joint Fires Coordination: FBE-Charlie

FBE-Charlie focused on Joint Fires Coordination, but addressed the deficiencies of tactical and operational scaling and the need for improved automation as identified in FBE-Alfa and -Bravo.[13] FBE-Charlie again used LAWS to prioritize operational targets and fires in accordance with the commander's intentions. It also introduced rudimentary tools for airspace deconfliction and for the control and coordination of fires cells.[14]

FBE-Charlie used the ROF concept to examine the operational issues associated with dividing the battlespace into two major joint fires areas: the near battlespace within the Fire Support Coordination Line (FSCL)[15], and the far battlespace beyond. By structuring the ROF in this way, it afforded the JFC the opportunity to designate a portion of the assets as direct support for fires within the FSCL, and to utilize them as general support for fires outside the FSCL. Certain types of ordnance chosen for their attributes such as shorter range and more contained effects could be designated for use within the near battlespace; where friendly forces are operating and may require their use within close proximity. This also allows the JFC to release ordnance with longer ranges and greater destructive capabilities for use in the deep battlespace. This partitioning of the battlespace allows the JFC to create joint fires cells. These cells will

allow commanders and operators to focus on that portion of the battlespace for which they are most directly responsible.

FBE-Charlie also examined the application of the Area Air Defense Commander (AADC) concept, a prototype system developed by the Applied Physics Laboratory at John Hopkins University. This portion of the experiment dealt with using AADC to increase the capacity for distributive collaborative planning for all phases of an operation or campaign — and specifically for theater air defense. The AADC concept also contributed to producing and maintaining a Single Integrated Air Picture (SIAP). Both AADC and SIAP are the first steps toward expanding the coordination of air defense engagements across a large littoral Area of Responsibility (AOR).[16] Integration of capabilities resident in LAWS and AADC — and especially the SIAP — will make a considerable contribution toward the deconfliction of airspace occupied by aircraft and missiles.

This is important because, as the ROF allows for the progression away from the one-to-one relationship between the FO/FAC and individual weapons platforms, the more imperative it becomes for the netted system to deconflict automatically when responding to CFF. The ROF must provide for airspace deconfliction and prevention of fratricide on the ground as it utilizes ships, aircraft, and land-based weapons systems that are no longer located in specific fire-support areas or allocated in direct support roles. The ROF must have the ability to fix each delivery system and track the path the ordnance will follow. Deconfliction in such a manner enables the JFC to safely and accurately service as many targets simultaneously as the number of assets within the ROF will allow.

However, as a recent *Proceedings* article details, this increased capability to respond to a greater number of CFF from distributed tactical units could rapidly exceed the capabilities of available weapons platforms and ordnance inventories.[17] This situation could also occur at the operational level during engagement of interdiction and deep strike targets. Automation of target prioritization, commander's guidance, and inventory and allocation functions, as mentioned above, will help to prevent this from happening. Additionally, the number and type of both weapons platforms and ordnance must undergo realistic evaluation to ensure they are available in sufficient numbers to allow the ROF to function as designed.

Major Theater Application: FBE-Delta

As the next progressive step to refining the ROF concept, FBE-Delta took place in a mature theater in conjunction with a major scheduled exercise. Conducted in the Korean Theater of Operations, the experiment simulated joint, combined, and interagency assets. FBE-Delta tailored the experimentation to the sub-unified CINC's major warfighting concerns for Korea. Specifically, two of the theater commander's priorities for the FBE-Delta simulation were counterfire (CF) and counter-special operations forces (CSOF).[18]

To explore the ability of the ROF to improve CF capabilities in this theater, FBE-Delta examined a command and control mechanism called the Land-Sea Engagement Network.[19] This network linked LAWS stations with the Automated Deep Operations Coordination System (ADOCS)[20], which allowed the ROF to contribute to the coordinated engagement of CF targets. The network digitally exchanged targeting

information and selected the most efficient means of engagement, regardless of which sensor established the threat. By combining Navy sea-based Aegis radar with Army land-based Firefinder radar to detect and identify the origin of enemy fires through LAWS and ADOCS, the network created a Common Operational Picture (COP). This CF COP provides the commander with a near-real-time representation of (1) the enemy's employment of fires, (2) how friendly force are responding, and (3) how the commander should reallocate assets to respond. Not only does this capability expand the JFC's awareness of the CF situation and promote the most efficient use of fires assets, it provides the additional radar and ordnance this particular theater requires to accomplish the CF mission.

FBE-Delta simulated issues relating to CSOF by using specialized software to expand LAWS. The automated software created an integrated sea-land digital COP that facilitates the detection, tracking, and battle handoff between component commanders during CSOF engagements.[21] The interface between LAWS, ADOCS, and additional inputs from the Air Defense Systems Integrator provided the Air, Naval, and Ground Component Commanders seamless connectivity.

Finally, FBE-Delta examined the expansion of LAWS to support over-the-horizon digital CFF, and requirements for reorganization of supporting arms coordination agencies such as the Supporting Arms Coordination Center and the Tactical Air Command Center as they evolve with the ROF.

Because individuals from U.S. Forces Korea were intimately familiar with the requirements of the Korean Theater of Operations, their inputs to the expansion of LAWS provided specific information that operators could translate into the desired

capabilities. Execution of future FBEs in a variety of theaters will provide the information necessary to increase LAWS capabilities and to meet other area commander's specific needs.

Urban Littorals: FBE-Echo

FBE-Echo was the first of the series conducted in the urban littoral, and the second executed in conjunction with a Marine Corps AWE. The central pieces of this experiment were (1) the deployment and support of Marine forces ashore, (2) the protection of naval forces as they enter and remain in the littorals indefinitely, and (3) the employment of precision engagement in an urban littoral environment.[22]

The requirement for the Navy to launch Marines into urban terrain and remain in the littoral region to provide sea-based command and control, logistics support, and force protection is essential to the concepts of *Forward... From the Sea, OMFTS,* and *Ship to Objective Maneuver (STOM)*[23].

FBE-Echo explored a concept intended to ensure maritime dominance against asymmetric threats called the Maneuverable Naval Force Protection Capability.[24] The concept provides the JFC and component commanders a means to protect assets throughout the littoral operations area using operational control of forces, engagement capabilities, and access to theater and national Indications and Warning data. FBE-Delta demonstrated how the ROF could substantively strengthen the targeting and engagement aspect of this capability. Specifically, the experiment connected the ROF engagement grid to a variety of surveillance platforms, ranging from Coast Guard cutters to Unmanned Aerial Vehicles to P-3 Antisubmarine Warfare aircraft.

FBE-Echo also examined the application of ROF principles to urban warfare concerning preplanned and time-sensitive targets by exploring how to network sensor data into the ROF engagement grid. The experiment made clear that with the increasing criticality of sensors in net-centric warfare, a usage hierarchy similar to that used in the ROF's weapons-target pairing is required. Such a hierarchy will reduce conflicts resulting from competing situational awareness and targeting demands placed on a limited number of sensors. Additionally, to afford the JFC the ability to strike time critical and mobile targets effectively, an organic sensor capability for targeting is necessary.[25] Finally, to support urban combat operations, the FBE process must explore the development of naval surface fires for precision engagement of targets residing in urban canyons — weapons that can achieve a sufficiently steep flight path to descend between towering structures

Future Experimentation

FBE-Foxtrot, scheduled for December 1999, will take place in the Mediterranean Sea in the European Command's AOR. This experiment will incorporate the results of FBE-Echo, may involve NATO participants, and will focus on Weapons of Mass Destruction (WMD) and Time Critical Targets.[26]

Continued development of the ROF through progressive Fleet Battle Experiments is essential. It is clear from the work done to date that it is necessary to develop and employ a C4ISR network that provides near real-time sensor-to-shooter connectivity into the ROF engagement grid. This will make it possible to effectively engaged time critical mobile targets. Without fielding such a capability, it is unlikely

the ROF concept will provide the JFC the ability to deal with elusive WMD and weapons systems such as the SCUD missile launcher.[27]

Furthermore, network technology as it applies to warfare today is an advantage: in the future, it will be a necessity. Upcoming FBEs must include government agencies, civilian organizations and our most reliable allies. It is not enough for CINCs, JFCs, and component commanders to interface within the U.S. Armed Forces alone. Critical allies and other agencies must participate in the design and development of the net-centric architecture. This will ensure that future hardware and software are compatible and facilitate the interface of complex systems.[28]

Summary of Recommendations

As the ROF concept matures, development of several critical functions must take place. First, one of the key advantages of the ROF is its ability to provide more accurate and more timely fires from a group of distributed weapons platforms. To take even greater advantage of these capabilities, the next generation LAWS should automate by digital incorporation into the system the JMEM, the commander's intent and targeting priorities, and ground forces tracking data. This will ensure the most rapid selection of the most appropriate ordnance and firing platform when viewed in light of the target characteristics, location, proximity to friendly forces, and the commander's preference.

Second, the ROF decision system must make a distinction between tactical and operational fire missions. The system must be capable of prioritizing between immediate fires required to engage enemy forces in close proximity to friendly forces

and fires intended for interdiction or deep strikes. Provisions for voice communications to relay a sense of urgency is also necessary.

Third, the ROF must provide for greater airspace deconfliction and prevention of fratricide as it incorporates a variety of distributed weapons platforms and allows a progression away from the direct relationship between requesting and responding agencies. The ROF must track ground units and delivery platforms locations and ensure friendly troops, aircraft, and vessels are not attacked.

Finally, the ROF must establish a hierarchy to allocate the use of limited assets. Sensors will be in high demand as commanders and operational forces increasingly require information for both situational awareness and targeting requirements. Weapons platforms and ordnance stores will also be in greater demand, as awareness of the battlespace and acquisition of targets becomes faster and more accurate through the use of netted sensor systems.

Conclusion

As the Navy develops and implements a net-centric suite of systems and doctrine, it is critical that the concepts and capabilities fit the task. Leap-ahead concepts like the Ring of Fire must realistically consider how the threat and the battlespace environment will conspire to confuse and defeat technology, and adapt accordingly. The progressive development of the Ring of Fire through the Fleet Battle Experiment process is therefore essential. Experimentation to date has made great strides in overcoming the deficiencies encountered, and in anticipating future requirements. In addition, as technology advances, experimentation can examine and

incorporate further capabilities into the Ring of Fire. To ensure we proceed on the proper course, operational input must continue to be the basis for further development. Likewise, examination of the results must continue to take place forward in the CINC's AORs and adaptation to the specific needs of the theater commanders must remain a high priority.

Finally, technology can not overcome every obstacle or provide every solution. We must recognize and truthfully acknowledge those areas that may never be solved through technological advancements and find other avenues to address them.

Notes

[1] Ross Mitchell, "Ring of Fire," U.S. Naval Institute Proceedings, November 1997, 54.

[2] U.S. Naval War College, Fleet Battle Experiment Bravo: Quicklook Report (Newport, RI: 1997), 1.

[3] U.S. Naval War College, Fleet Battle Experiment Alfa: Quicklook Report (Newport, RI: 1997), 2.

[4] Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance.

[5] U.S. Naval War College, Fleet Battle Experiment Alfa: Quicklook Report (Newport, RI: 1997), 2.

[6] Joint Munitions Effectiveness Manual (JMEM). A publication providing a single, comprehensive source of information covering weapon effectiveness, selection, and requirements for munitions. In addition, the closely related fields of weapon characteristics and effects, target characteristics, and target vulnerability are treated in limited detail required by the mission planner. Although emphasis is placed on weapons that are currently in the inventory, information is also included for some weapons not immediately available but projected for the future. (Joint Pub 1-02)

[7] U.S. Navy Department, Office of the Chief of Naval Operations, Naval Fire Support "Ring of Fire" N86 Point Paper (Washington: n.d.), 1.

[8] Fleet Battle Experiment Bravo: Quicklook Report, 1-7.

[9] LAWS is the current version of the Naval Fires Control System hardware and software that performs the critical netted functions of the ROF. It runs on a variety of platforms, including the Personnel Computer using a Windows/NT based operating systems.

[10] Advanced Field Artillery Tactical Data System (AFATDS). A joint Army/Marine Corps program to replace the Initial Fire Support Automated System (IFSAS). It employs a building block approach to automate into fire support functionality. As a multi-service, integrated, battlefield management and decision support system, it assists the commander in the planning, delivery, and coordination of supporting arms. AFATDS satisfies the fire support command and control requirements of the Marine Corps. (USMC Concepts and Issues 99)

[11] David H. Blake, Joe R. Penny, and Allen T. Hjelmfelt, Fleet Battle Experiment Bravo-Ring of Fire Analysis Report (Center for Naval Analysis, Alexandria, VA: 1998), 16.

[12] Fleet Battle Experiment Bravo: Quicklook Report, 3.

[13] U.S. Naval War College, Fleet Battle Experiment Charlie: Quicklook Report (Newport, RI: 1997), 1.

[14] Ibid., Enclosure (2), 4.

[15] Fire Support Coordination Line (FSCL). A line established by the appropriate ground force commander to ensure coordination of fires not under his control but which may affect current tactical operations. The FSCL is used to coordinate fires of air, ground, and sea weapon systems using any type of ammunition against surface targets. The FSCL must be coordinated with the appropriate tactical air commander and other supporting elements. Supporting elements may attack targets forward of the FSCL without prior coordination with the ground force commander, provided the attack will not produce adverse effects on or

to the rear of the line. Attacks on surface targets behind this line must be coordinated with the appropriate ground force commander. (Joint Pub 1-02)

[16] Fleet Battle Experiment Charlie: Quicklook Report, Enclosure (1), 1-4.

[17] F. B. West, "Ring of Fire or Ring of Smoke." U.S. Naval Institute Proceedings, November 1998, 38.

[18] U.S. Naval War College, Fleet Battle Experiment Delta: Quicklook Report (Newport, RI: 1997), 1-2.

[19] Land-Sea Engagement Network is an unofficial term used to refer to the linking of LAWS with ADOCS in order to allow the ROF to contribute to the coordinated engagement of Counterfire targets. A Common Operational Picture was created by linking Navy sea-based Aegis radar with Army Firefinder land-based radar to give the operational commander a greater capability to detect, identify, and engage Counter Fire and Counter-Special Operation Forces targets.

[20] Automated Deep Operations Coordination System (ADOCS) is designed to automate and simplify the planning and execution process. The ADOCS also serves as an electronic link to the to the Fire Direction System. As ADOCS matures, it will also serve as a link to the Maneuver Control System and the All Source Analysis System. The ADOCS significantly speeds up the coordination and staffing process and thus is ideal for processing and engaging targets with short dwell times. The ADOCS graphically displays numerous types of critical friendly and enemy battlefield geometry sets to include unit locations, air corridors, and restricted fire areas. The ADOCS operates on a local area network. (FM 100-13)

[21] Fleet Battle Experiment Delta: Quicklook Report, 2-1.

[22] U.S. Naval War College, Fleet Battle Experiment Echo: Quicklook Report (Newport, RI: 1997), 1.

[23] Ship to Objective Maneuver (STOM) applies the principles and tactics of maneuver warfare to the littoral battlespace. Specifically, it will allow for conducting combined arms penetration and exploitation operations from over the horizon directly to objectives ashore without stopping to seize, defend, and build up beachheads or landing zones. (USMC Warfighting Concepts for the 21st Century)

[24] The Maneuverable Naval Force Protection Capability is designed to provide the capability to protect against asymmetric threats in port, at off-shore anchorages, or in other littoral operation areas. Specific asymmetric threats addressed were multiple high-speed small boats, combat swimmers, anti-ship cruise missiles aboard trucks ashore, and low-slow flying aircraft.

[25] Fleet Battle Experiment Echo: Quicklook Report, 7.

[26] U. S. Naval War College, "Ring of Fire Concept Brief" (Maritime Battle Center, Newport, RI: 1998).

[27] Phillip Comstock and Grant Ayres, Attack Operations Against Critical Mobile Targets (Draft White Paper, U.S. Atlantic Command, J-9 Concepts Division, Norfolk, VA: 1999), 5-6.

[28] David C. Gompert, Richard L. Kugler, and Martin C. Libicki, Mind the Gap: Promoting a Transatlantic Revolution in Military Affairs (National Defense University Press, Washington, DC: 1999), 48-49.

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________. Fleet Battle Experiment Bravo. Quicklook Report. Newport, RI: September 1997.

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